Hydrogen Production by Homogeneous Catalysis: Alcohol Acceptorless Dehydrogenation - DTU Orbit (08/11/2017)

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The lifestyle in the modern western world is highly depending on the accessibility of energy and bulk chemicals. Energy is needed in the transportation sector, but also domestic and industrial consumptions of energy is comprehensive. Bulk chemicals are probably more important than people realize, and are fundamental for the thrive of almost all business fields. The latter include the industries of agriculture, food additives, pharmaceuticals, electronics, plastic, fragrances, and more. Today, the major source of both energy and bulk chemicals is fossil fuels, being responsible for more than 80 % of the energy supplies. The large amounts of CO_2 release owing to fossil fuel usage is believed to cause global warming on the long term, a highly undesired environmental consequence. Hence, it is of critical importance that alternative sources are developed and implemented in the society. One suggested solution for the energy sector is the application of a *hydrogen economy*, which transform the chemical energy in water and/or biomass into hydrogen. Considered as an energy carrier, hydrogen is then transported to the site of use where fuel cells convert its chemical energy into electricity.Here, we review the progress in hydrogen production from biomass using homogeneous catalysis. Homogeneous catalysis has the advance of generally performing transformations at much milder conditions than traditional heterogeneous catalysis, and hence it constitutes a promising tool for future applications for a sustainable energy sector. In particular, only alcohol containing substances are covered. As such, alcohol acceptorless dehydrogenation (AAD) is the main topic of this review. Moreover, it is more easily investigated for eluding mechanistic property.This review is divided up in four main chapters according to substrates. The first chapter, Model Substrates, describes the development of alcohol acceptorless dehydrogenation using substrates that can be categorized as model substrates. This includes e.g. isopropanol. The second chapter, Substrates with Synthetic Applications, deals with synthetic applications of alcohol acceptorless dehydrogenation. The third chapter, Biorelevant Substrates, concentrates on the use of alcohols such as ethanol, which are biomass related. The topic is alcohol acceptorless dehydrogenation reactions for both H_2 production and the concurrent synthetic application. Finally, Chap. 4, Substrates for H_2 Storage, is focusing on the use of alcohol acceptorless dehydrogenation of alcohols relevant as future H_2 storage molecules. This is in particular methanol.

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